United States
Department of
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Acid Rain

in the South

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ACID RAIN - IN THE SOUTH

PREFACE

Acid Precipitation in Forestry was published in May 1984 by the Soil, Water and Air Unit, USDA Forest Service, Southern Region. This publication highlighted a few facts about acid precipitation and its relationship to Southern Forestry. The following is an update for the acid precipitation phenomenon.

What is Acid Rain?

The prime contributors to acid rain are sulfur and nitrogen oxides which are formed in the atmosphere as sulfur and nitrogen are emitted into the atmosphere in the form of smoke, smog or invisible noxious matter. These gases, along with many solid particles, fall to the earth in the form of wet and dry deposition. This "Acid Rain" has the potential to leach vital nutrients out of forest soils while releasing toxic metals and chemicals into the soil and water.

Until recent years, the Southern U.S. has been relatively "untouched" by acid rain. The Northeast, like many European countries, has suffered serious damages from acid rain. About 99% of sulfur oxide and 90% of nitrogen oxide in the atmosphere originate from power plants industry and the automobile. More and more of these sources have moved southward in the last decade bringing with them acid rain and its potentially damaging effects. The following evidence of suspected acid rain damage in the south has been reported:

----West Virginia----

-About one quarter of West Virginia's fragile trout streams are showing a decline in trout populations.
-Some fish stocking is delayed until late spring to allow acid levels to recover following acid snow melt and spring storms.

----Virginia----

-Soils in the Shenandoah National Park are losing buffering capacity, and concentrations of toxic metals lethal to fish are leaching into some streams.

----Blue Ridge Province (GA, NC, SC, TN)----

-There is a rapid drop in alkalinity levels in some lakes.
-Where samples have been taken stream acidity is rising.
-In some streams, acidity increases of 100% have been measured in the 24 hour period after some storms.
-Fish-kills have occurred in North Carolina trout farms following acidic rainfall.
-Serious spinal deformities in valuable smallmouth bass were found in 7 reservoirs in 1981-1982.
-Sulfate levels have doubled in the Neuse River in North Carolina since the 1950's.

-In a few cases, rain in the South Carolina piedmont region is acidic enough to release aluminum and other toxic metals from soils and into streams.

----Arkansas and the Ozark Mountains----

-Average pH of some streams in Arkansas is now 4.74, considerably more acidic than normal.

The Potential effects from acid rain is insidious:

-Nearly 40% of Alabama surface water areas and nearly 45% of Mississippi surface water areas exhibit low to moderate ability to reduce acidity.
-4600 Florida lakes are sensitive to acidification.

The Acid Precipitation Act of 1980 established the Interagency (USDA, EPA, NOAA) Task Force on acid precipation. The purpose of this National Program is to increase understanding of the causes and effects of acid precipitation. The general strategy of the program is to:

-Build upon previous efforts to develop a federal acid rain program.
-Use existing scientific knowledge for timely assessments and where appropriate, make policy recommendations.
-Conduct research to develop more knowledge.
-Establish a long term National Trends Network (NTN) for acid deposition.
-Evaluate information and the policy implications.

The Interagency Task Force reports annually to the Congress, the President, and the nation on progress in research and the implications of expanding knowledge about acid deposition.

Some of the questions to be answered by Interagency Task Force are:

-How do chemical and physical atmospheric processes control acid deposition?

-What are the interactions between acid rain and other pollutants affecting ecosystems?

-What is the extent of damage on sensitive aquatic ecosystems in the U.S.?

-What is the relative contribution of local versus distant sources of acidic materials?

-How great is the potential for acid deposition damaging forests, crops and soils?

-What are the most cost-effective ways to manage acid deposition?

Soil Scientists believe that most managed agricultural soils are not very vulnerable to acid precipitation. The sulfur and nitrogen deposited by acid precipitation are primary plant nutrients. Because of this, acid rain will have both positive and negative effects on plant growth. The direct effects on crops therefore appear less significant than those related to other air pollutants such as ozone.

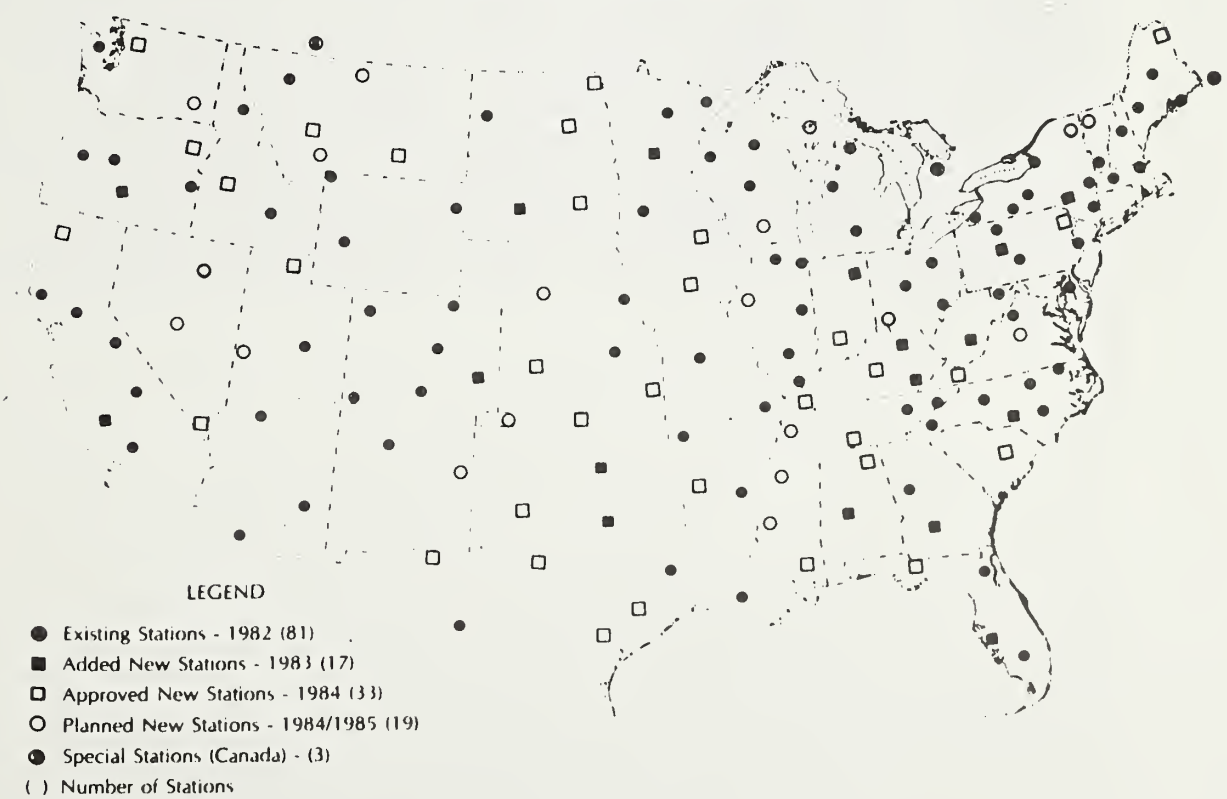
Initial studies on forest productivity indicated that forests were not threatened by acid deposition. In fact, the nitrogen deposition was even expected to increase production. In some areas this hypothesis proved true. However, in the past few years scientists have observed increasing damage to forests. Many scientists now believe nitrogen oxides and oxidants such as ozone are effecting growth changes within the forest community.

The 1983 Annual Report to the President and Congress by the National Acid Precipitation Program states that "Wet deposition can be accurately documented but no standardized scientific techniques yet exist to measure dry deposition, which may account for 25 to 80 percent...of the acidity deposited in some areas". This statement indicates that research is still needed to develop a system to measure and define the effects of acid deposition.

Monitoring Under the National Precipitation Act

To help define the extent and degree of acid deposition, a nationwide long term monitoring system was instituted in 1982 (National Trends Network). The material collected by this network is to report various types of deposition. Map 1 shows site locations and scheduling for installing monitoring sites.

Map 1: National Trends Network



The National Trends Network has the following responsibility:

1. Determine the spatial and temporal variations in the composition of atmospheric deposition within the U.S.

2. Develop methods for reliable measurement of dry deposition.

3. Support a global trends network (GTN) by operating sites at remote locations throughout the world.

Research Under the Acid Precipitation Act:

Research on terrestrial effects is another undertaking with specific goals. This work is being handled by a team referred to as the Terrestrial Effect Task Group. The Task Group goals are:

1. Determine impacts of acid deposition on soil chemistry and biological production.

2. Determine the effect on soil processes such as leaching, weathering, ion mobility and organic decomposition.

3. Determine effect on interrelationship between soil, water, plant components.

4. Examine and/or develop techniques for mitigating adverse impacts.

Perhaps the most frustrating and perplexing aspect of the acid deposition issue is that of trying to relate the historical trends of emissions of acid with proven deposition. It was first assumed that if such a relationship were established, the solution would be simply to cut back on specific sources of pollution. This assumption is valid but difficult to attain due to the complexity of the pollutant dynamics. Factors affecting the dynamics of pollution include: (1) Change in height of emissions with time (i.e., the introduction of tall stacks); (2) changed spatial distribution with time (i.e., replacement of many small SO_2 sources with fewer larger sources) (3) change in the amount and type of other reactive pollutants, and (4) an unknown, but possibly significant, change in the temporal and spatial distribution of background pollutant levels entering eastern North America from elsewhere.